CLAIMS

1. An electric motor controller comprising:

an inverter circuit having switching devices and diodes for converting a direct current into an alternating current (AC) and supplying an AC power to a motor,

a motor current detection section for detecting a current flowing through said motor and outputting a detected signal, and

an inverter control section for controlling said inverter circuit on the basis of the output of said motor current detection section, wherein

said inverter control section comprises:

a setting section for outputting a set value,

a detection section, having a reactive current computing section for computing a reactive current by using the detected signal from said motor current detection section, for outputting a detected value representing the driving condition of said motor on the basis of the output of said reactive current computing section, and

a computing section for controlling said inverter circuit on the basis of the output of said setting section and the output of said detection section.

2. A motor controller in accordance with claim 1, wherein

said inverter control section comprises:

a frequency setting section for outputting the command signal of the rotation frequency of said motor,

a wave generation section for generating a rotation phase signal from the command signal of said frequency setting section,

a reactive current computing section for computing a reactive current from the rotation phase signal of said wave generation section and the detected signal of said motor current detection section,

a reactive current command section for outputting the command value of the reactive current,

an error voltage computing section for computing an error voltage from the difference between the output of said reactive current computing section and the output of said reactive current command section,

a V/f conversion section for obtaining a reference voltage from the command signal of said frequency setting section,

an adder for computing a command value of voltage applied to the motor from the outputs of said error voltage computing section and said V/f conversion section, and

an output command computing section for generating a control signal from the outputs of said wave generation section and said adder and supplying the control signal to said inverter circuit.

3. A motor controller in accordance with claim 1, wherein

said inverter control section comprises:

a frequency setting section for outputting the command signal of the rotation frequency of said motor,

a wave generation section for generating a rotation phase signal from the command signal of said frequency setting section,

a reactive current computing section for computing a reactive current and an active current computing section for computing an active current, from the rotation phase signal of said wave generation section and the detected signal of said motor current detection section,

a phase difference ϕ computing section for computing a phase difference ϕ from the outputs of said reactive current computing section and said active current computing section,

a phase difference ϕ command section for outputting the command value of the phase difference ϕ,

an error voltage computing section for computing an error voltage from the difference between the output of said phase difference ϕ command section and the output of said phase difference ϕ computing section,

a V/f conversion section for obtaining a reference voltage from the command signal of said frequency setting section,

an adder for computing said command value of voltage applied to the motor from the outputs of said error voltage computing section and said V/f conversion section, and

an output command computing section for generating a control signal from the outputs of said wave generation section and said adder and supplying the control signal to said inverter circuit.

4. A motor controller in accordance with claim 1, wherein

said inverter control section comprises:

a frequency setting section for outputting the command signal of the rotation frequency of said motor,

a wave generation section for generating a rotation phase signal from the command signal of said frequency setting section,

a reactive current computing section for computing a reactive current and an active current computing section for computing an active current, from the rotation phase signal of said wave generation section and the detected signal of said motor current detection section,

a phase difference α computing section for computing a phase difference α between a motor applied voltage and a motor induced voltage from the output of said reactive current computing section, the output of said active current computing section and a command value of voltage applied to the motor,

a phase difference α command section for outputting the command value of the phase difference α,

an error voltage computing section for computing an error voltage from the difference between the output of said phase difference α command section and the output of said phase difference α computing section,

a V/f conversion section for obtaining a reference voltage from the command signal of said frequency setting section,

an adder for computing said command value of voltage applied to the motor from the outputs of said error voltage computing section and said V/f conversion section, and

an output command computing section for generating a control signal from the outputs of said wave generation section and said adder and supplying the control signal to said inverter circuit.

5. A motor controller in accordance with claim 1, wherein

said inverter control section comprises:

a frequency setting section for outputting the command signal of the rotation frequency of said motor,

a wave generation section for generating a rotation phase signal from the command signal of said frequency setting section,

a reactive current computing section for computing

a reactive current and an active current computing section for computing an active current, from the rotation phase signal of said wave generation section and the detected signal of said motor current detection section,

a phase difference β computing section for computing a phase difference β between the reference axis of the rotor of said motor and the motor current from the output of said reactive current computing section, the output of said active current computing section, the command value of the command value of voltage applied to the motor and the command signal of said frequency setting section,

a phase difference β command section for outputting the command value of the phase difference β,

an error voltage computing section for computing an error voltage from the difference between the output of said phase difference β command section and the output of said phase difference β computing section,

a V/f conversion section for obtaining a reference voltage from the command signal of said frequency setting section,

an adder for computing said command value of voltage applied to the motor from the outputs of said error voltage computing section and said V/f conversion section, and

an output command computing section for generating a control signal from the outputs of said wave generation section

and said adder and supplying the control signal to said inverter circuit.

6. A motor controller in accordance with claim 1, wherein

said inverter control section comprises:

a frequency setting section for outputting the command signal of the rotation frequency of said motor,

a wave generation section for generating a rotation phase signal from the command signal of said frequency setting section,

a reactive current computing section for computing a reactive current and an active current computing section for computing an active current, from the rotation phase signal of said wave generation section and the detected signal of said motor current detection section,

a phase difference δ computing section for computing a phase difference δ between the reference axis of the rotor of said motor and the applied voltage from the output of said reactive current computing section, the output of said active current computing section, the command value of the motor applied voltage and the command signal of said frequency setting section,

a phase difference δ command section for outputting the command value of the phase difference δ,

an error voltage computing section for computing an error voltage from the difference between the output of said

phase difference δ command section and the output of said phase difference δ computing section,

a V/f conversion section for obtaining a reference voltage from the command signal of said frequency setting section,

an adder for computing said command value of voltage applied to the motor from the outputs of said error voltage computing section and said V/f conversion section, and

an output command computing section for generating a control signal from the outputs of said wave generation section and said adder and supplying the control signal to said inverter circuit.

7. A motor controller in accordance with one of claims 2 to 6, wherein

said inverter control section comprises:

a phase compensation section for generating a phase compensation amount from one of:

the difference between the output of said reactive current command section and the output of said reactive current computing section,

the difference between the output of said phase difference ϕ command section and the output of said phase difference ϕ computing section,

the difference between the output of said phase difference α command section and the output of said phase

difference α computing section,

the difference between the output of said phase difference β command section and the output of said phase difference β computing section and

the difference between the output of said phase difference δ command section and the output of said phase difference δ computing section, and

an adder for adding said phase compensation amount to the output of said wave generation section.

8. A motor controller in accordance with claim 7, wherein

said inverter control section comprises:

a variation computing section for amplifying the difference between the last and present results of computations repeated at predetermined time cycles by using one computing section selected from among said reactive current computing section, said phase difference ϕ computing section, said phase difference α computing section, said phase difference β computing section and said phase difference δ computing section.

9. A motor controller in accordance with claim 7, wherein

said inverter control section comprises:

a current compensation section for computing the difference between the average value of an instantaneous current

obtained on the basis of the outputs of said active current computing section and said reactive current computing section and the instantaneous value of said instantaneous current.

10. A motor controller in accordance with claim 7, wherein

said inverter control section comprises:

at least two command sections selected from among said reactive current command section, said phase difference ϕ command section, said phase difference α command section, said phase difference β command section and said phase difference δ command section,

at least two computing sections selected from among said reactive current computing section, said phase difference ϕ computing section, said phase difference α computing section, said phase difference β computing section and said phase difference δ computing section, corresponding to said selected plurality of command sections, and

a feedback switching section for selecting one of at least two feedback loops on the basis of the outputs of at least two said command sections and at least two said computing sections corresponding to one another.

11. A motor controller in accordance with claim 10, wherein the command value of one of said reactive current command section, said phase difference ϕ command section, said phase difference α command section, said phase difference β command

section and said phase difference δ command section, selected by said feedback switching section, is set as the average value of one of said reactive current computing section, said phase difference ϕ computing section, said phase difference α computing section, said phase difference β computing section and said phase difference δ computing section before the selection.

12. A motor controller in accordance with claim 11, wherein after the selection by said feedback switching section the state of said feedback loop is held in the state obtained after the selection during a predetermined period.

13. A motor controller in accordance with claim 7, further comprising:

a voltage detection section for detecting the voltage of said direct current and outputting the detected signal, and

a saturated voltage determination section for determining the saturation of the voltage on the basis of the signal from said voltage detection section and said motor applied voltage command value, wherein

the output of one of said reactive current command section, said phase difference ϕ command section, said phase difference α command section, said phase difference β command section and said phase difference δ command section is changed on the basis of the output of said saturated voltage determination section.

14. A motor controller in accordance with claim 13, wherein

said inverter control section carries out control so that the output of said frequency setting section does not increase when said command value of voltage applied to the motor exceeds a first predetermined voltage value larger than the signal from said voltage detection section, and said inverter control section carries out control so that the output of said frequency setting section does not decrease when said command value of voltage applied to the motor is below a second predetermined voltage value smaller than the output of said voltage detection section.

15. A motor controller in accordance with claim 7, said inverter control section comprises:

an instantaneous current computing section for computing an instantaneous current on the basis of the output of said reactive current computing section and the output of said active current computing section, wherein the output of said frequency setting section is held constant for a predetermined time when the output of said instantaneous current computing section is larger than a predetermined value.

16. A motor controller in accordance with claim 7, said inverter control section comprises:

an instantaneous current computing section for computing an instantaneous current on the basis of the output

of said reactive current computing section and the output of said active current computing section, wherein one of the outputs of said frequency setting section, said reactive current command section, said phase difference ϕ command section, said phase difference α command section, said phase difference β command section and said phase difference δ command section is made small in the case when the output of said instantaneous current computing section is larger than a predetermined value.

17. A motor controller in accordance with claim 7, wherein

said inverter control section changes one of the outputs of said reactive current command section, said phase difference ϕ command section, said phase difference α command section, said phase difference β command section and said phase difference δ command section.

18. A motor controller in accordance with claim 5, wherein

said motor is a non-salient pole motor, and

said inverter control section sets the output of said phase difference β command section at zero.

19. A motor controller in accordance with claim 5, wherein

said motor is a salient pole motor, and

said inverter control section determines the output of said phase difference β command section on the basis of the

outputs of said reactive current computing section and said active current computing section.

20. A motor controller in accordance with claim 1, further comprising:

a motor voltage detection section for detecting the voltage of said motor, and

a voltage detection section for detecting the voltage of said direct current, wherein

said inverter control section further comprises:

a position estimation section for detecting the position of the rotor of said motor on the basis of the output of said motor voltage detection section,

a frequency computing section for obtaining the rotation frequency of said motor on the basis of the output of said position estimation section,

an error speed computing section for obtaining the error of the motor rotation speed from the output of said frequency setting section and the output of said frequency computing section, and

a switching section for selecting said command value of voltage applied to the motor or the output of said error speed computing section, wherein

when said switching section selects the output of said error speed computing section, said wave generation section outputs a signal having a rectangular rotation phase waveform.

21. A motor controller in accordance with claim 20, wherein

when the waveform generated by said wave generation section is changed from a sine wave to a rectangular wave or from a rectangular wave to a sine wave,

the output of said output command computing section immediately after the change is set so that the amount of the magnetic flux of said motor is maintained to the amount of the magnetic flux before the change.

22. A motor controller in accordance with claim 1, wherein

said motor current detection section has current sensors for detecting currents having two or more different phases, and

when a one-phase switching device included in said inverter circuit turns ON before said motor is driven, the currents of the two or more phases of the motor windings are measured, the average value thereof is obtained, and the average value is used to correct the detected current of said motor current detection section.

23. A motor controller in accordance with claim 1, wherein

said motor current detection section has alternating current sensors, and

the detected phase deviations of said alternating

current sensors are compensated for.

24. A compressor for use in an air conditioner and a refrigerator including said motor controller in accordance with claim 1.

25. A fan including said motor controller in accordance with claim 1.

26. A pump including said motor controller in accordance with claim 1.